Report of investigation into the fatal accident caused by sinking of a local motor trading boat off Siu A Chau on 18 October 2007
Purpose of Investigation

This incident is investigated, and published in accordance with the IMO Code of the International Standards and Recommended Practices for a Safety Investigation into a Marine Casualty or Marine Incident, Resolution MSC.255(84). The purpose of this investigation conducted by the Marine Accident Investigation and Shipping Security Policy Branch (MAISSPB) of Marine Department is to determine the circumstances and the causes of the incident with the aim of improving the safety of life at sea and avoiding similar incident in future.

The conclusions drawn in this report aim to identify the different factors contributing to the incident. They are not intended to apportion blame or liability towards any particular organization or individual except so far as necessary to achieve the said purpose.

The MAISSPB has no involvement in any prosecution or disciplinary action that may be taken by the Marine Department resulting from this incident.
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1. Summary

1.1 At about 0945 on 18 October 2007, a local motor trading boat BM40070C (hereinafter referred as the Vessel) sank in a position about 300 metres north of Siu A Chau (Figure 1). The weather condition was fine with an easterly gentle breeze and slight sea and low swell. Four males and two females on board the sampan all fell into the sea. The Coxswain and two males were picked up by a passing fishing vessel and reported the incident to the Police while the two females and another male were found missing. The bodies of the females were located inside the sunken vessel by the divers of the Fire Services Department on the next day and the body of the missing male was located near Guishan Island in mainland China on 22 October 2007.

1.2 The sinking of the trading boat was due to improper loading of cargo. The Vessel with insufficient freeboard was flooded by seawater and sank.

1.3 The lack of experience of the unqualified coxswain in operating the Vessel in unsheltered waters was also a factor contributing to the accident.

Figure 1 – Sunken position of the motor trading boat
2. **Description of the Vessel**

2.1 **Particulars**

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>License No.</td>
<td>BM40070C</td>
</tr>
<tr>
<td>Type</td>
<td>Class IV Motor Trading Vessel</td>
</tr>
<tr>
<td>Length</td>
<td>7.32 metres</td>
</tr>
<tr>
<td>Breadth</td>
<td>3.58 metres</td>
</tr>
<tr>
<td>Gross Tonnage</td>
<td>9.01</td>
</tr>
<tr>
<td>Net Tonnage</td>
<td>6.31</td>
</tr>
<tr>
<td>Date of First Licensed</td>
<td>28 September 1993</td>
</tr>
<tr>
<td>Engine/Engine Power</td>
<td>1 x Gardner diesel engine/1 x 29.84 kW</td>
</tr>
</tbody>
</table>

Figure 2 – Photograph of *BM40070C*
3. **Sources of Evidence**

3.1 Coxswain and survivors of the motor trading vessel;

3.2 Marine Police, Hong Kong Police Force; and

3.3 Hong Kong Observatory.

4. **Outline of Events**

4.1 At about 0910 on 18 October 2007, the Vessel was moored at Tong Fuk pier for loading cargoes of about 400 pieces of bricks, two bags of sand and twelve bags of cement. The stack of bricks measuring about 0.9 metre x 0.9 metre x 0.9 metre were loaded on the forward deck of the vessel while the bags of sand and cement were loaded on a position forward of the midship of the Vessel. There were 4 males (including the Coxswain and three males) and two females on board the Vessel.

![Figure 3 – Plan showing the approximate position of cargoes and persons](image-url)
After completion of loading, the Vessel left Tong Fuk and proceeded to Siu A Chau for discharge of the cargoes. According to the Coxswain, the freeboard of the Vessel after loading was about 0.6 metre. The Coxswain sat and steered the Vessel at the port quarter. Two males sat on the sides while another male and two females sat on the stern of the Vessel. The Vessel was heading southwest and proceeded at a speed of about 7 knots. The weather was fine with a slight sea and low swell.

When reaching a position of about 300 metres north of Siu A Chau at about 0945, 2 passengers high-speed craft plying between Hong Kong and Macau passed nearby and caused a big wave of about 1.2 metre high to wash over the deck of the Vessel. With the ingress of sea water, the bow dipped into the sea. In an attempt to stop the Vessel from taking in more water, the Coxswain asked the males to jettison the bricks on the forward deck. Ingress of seawater continued and the Vessel sank with the cargoes and persons on board even after about 30 pieces of brick had been dumped overboard.

The Coxswain who sat on the stern and the two males who sat on the sides of the boat managed to swim away from the sunken Vessel. They were rescued by a passing fishing vessel which reported the incident to the Police. The Coxswain and the two males were sent to Cheung Chau Hospital for medical treatment. The remaining male and two females who sat on the stern of the Vessel were missing.

A search by various government launches and helicopter of Government Flying Service was carried out shortly after the reporting. The bodies of the missing two females were located inside the sunken Vessel by the divers of Fire Services Department at 1856 and 1929 respectively on the next day. The search operation was terminated at 1815 on 20 October 2007. The body of the missing male was located near Guishan Island in mainland China on 22 October 2007.
5. **Analysis of Evidence**

5.1 **Certification of vessel and operating personnel**

5.1.1 The Vessel was last inspected by Marine Department on 12 December 2006 and its licence was valid up to 13 December 2007. There is no restriction on the plying limit of the Vessel i.e. the Vessel can navigate anywhere within Hong Kong waters.

5.1.2 According to the local marine legislation, a qualified person with appropriate certificate is required to operate this vessel. The Coxswain was holding only a local master certificate of competency qualifying him to operate this Vessel within the limits of Cheung Chau Typhoon Shelter and he was not qualified to operate this vessel at the subject location.

5.2 **Weather and sea condition**

5.2.1 According to the weather report from the Hong Kong Observatory, the weather condition was fine and an easterly gentle breeze was prevailing in the area. Under the influence of the above wind, a slight sea and waves with a height of about 0.6 metre were expected.

5.3 **Sinking of Vessel**

5.3.1 A detailed analysis on the foundering of the Vessel can be found in the Report on the foundering of the wooden Class IV motor trading boat – BM40070C which is attached as Appendix. According to the statement of the truck driver who delivered the cargo to the Vessel, the total weight of cargo i.e. bricks and cement and sand loaded on board was about 1736 kilograms (kg). The bricks were placed close to the bow of the Vessel while the sand and cement were placed forward of amidships on deck. Due to the hull form of the Vessel, its stern could be pushed upward easily when it was hit by a rear wave. Such an action would press the bow downward. Placing the cargoes on the forward deck of the Vessel would make the Vessel trim forward and a reduction of freeboard on the bow. With a forward trim, the bow of the Vessel would have difficulty to rise when it encountered a wave. Ingress of seawater into the Vessel became easier
as the bow could not rise readily in response to wave action. Moreover, seawater which gained access onto the open forward deck would not drain off quickly due to lack of draining holes in the bulwark. When the most forward hold started to take in water, the bow would become even more difficult to rise in response to wave motion. As soon as the waterline at bow was over the height of the bulwark, continuous flooding would occur as water gained access below deck through the large hatch openings. As a result, the Vessel would sink very quickly.

5.4 Lifesaving appliances

5.4.1 Since fifteen pieces of lifejackets and a lifebuoy were found on the top of canopy of the Vessel after salvage, the Vessel was equipped with proper lifesaving appliances. However, due to the fast onset of the accident, none of the persons on board had time to wear any lifejackets.

5.5 Alcohol and Drug

5.5.1 The Coxswain claimed that he had not taken any alcohol or medicines before sailing. In this connection, there was no evidence to show that alcohol or drug was a contributory factor to the accident.

6. Conclusions

6.1 At about 0945 on 18 October 2007, a local motor trading boat BM40070C sank in a position about 300 metres north of Siu A Chau. There were four males and two females on the trading boat. Three males were saved by a passing vessel while the remaining male and two females were drowned.

6.2 At the time of the accident, the weather was fine with an easterly gentle breeze and slight sea and low swell.

6.3 The sinking of the trading boat was due to flooding by seawater caused by big waves generated by passing high-speed craft. Big waves gained access onto the deck of the Vessel easily due to its low freeboard after improper loading by cargoes of bricks, sand and cement. Inexperience of the unqualified coxswain in operating the Vessel in unsheltered waters was also a contributory factor of the accident.
7. Recommendations

7.1 A copy of this report is to be sent to the Coxswain of the trading boat drawing his attention on the findings of the investigation. He should be warned not to operate the Vessel outside the limits of Cheung Chau Typhoon Shelter and his vessel should be loaded properly in order to maintain a sufficient freeboard to prevent flooding of the Vessel by seawater.

8. Submissions

8.1 In the event that the conduct of any person or organization is commented in an accident investigation report, it is the policy of the Hong Kong Marine Department to send a copy of the draft report to that person or organization for their comments.
8.2 The final draft of the report was sent to the Coxswain of the trading boat.
8.3 No submission was received from the Coxswain of the trading boat.
Appendix

Report on the foundering
of the wooden Class IV motor trading boat – BM40070C

Prepared by: Ronnie Law
Senior Surveyor of Ships

Date: 13 June 2008

I. Introduction

1. BM40070C is a Hong Kong Class IV motor trading boat that sank in Hong Kong waters on 18 October 2007. At the request of MAI Section I went to inspect the boat. An attempt to re-establish the condition of the boat in water with its loaded cargoes was not successful because the boat was leaking badly. Nevertheless, during the visit, I was able to see the boat in its dry condition and to see it being placed in water before and after water ingress, and I was also shown by the Police the physical size of the cargoes (which consisted of bricks, sand and cement) that were onboard the boat at the time of the incident.

II. Description of BM40070C

Chinese junk construction

2. BM40070C was a wooden motorised boat built to small Chinese junk style, using traditional Chinese junk construction method. It was a strongly built wooden vessel fitted with a small engine placed at near amidships, driving a small single propeller by means of a steel tailshaft. The helm position was near the stern of the boat. Steering was by means of a lightly constructed steel rudder.

3. It was a boat typical of those commonly used in the typhoon shelter areas in Hong Kong. It had a sheltered area with a canopy top at aft. There was also an open deck at forward. The open deck extended from bow to nearly amidships.
4. During the inspection, I noticed that the forward open deck was only covered by thin wooden boards that were loosely in place. These boards were places loosely on top of the deck beams and the hatch openings. The forward open deck had a number of large hatch openings, which practically made the forward compartments open. That is, the forward open deck of the boat could take in water easily. As the boat was salvaged from sea bottom it was surprising that these boards did not float or drifted away as the boat sank.

No hatch covers

5. I could not see any hatch cover on the boat. Also, I could not see any securing arrangement for hatch covers.

High bulwark preventing water to drain away

6. There was a bulwark at all sides of the forward open deck. Apart from a very small drain hole at the bottom of the bulwark, one at port and one at starboard side, there was practically no other means to drain away entrapped water on deck. This means water coming onto the deck could not drain away quickly and would end up in getting into the holds below deck.

No damage at hull bottom

7. During the inspection, I could not see any damage at hull bottom or at any other part of the hull that would indicate the boat had landed on rock or had hit a hard object. The rudder was damaged badly which in my opinion could have been caused as the boat sank and landed at sea bottom.

Hull leak at bow

8. The boat had a flat truncated bow, the steel protection angle bars fitted at the corners were found to have dislocated, leaving large gaps that might allow water to get into the most forward hold of the boat. It was not apparent whether the bars were dislocated before or after the incident. It was possible for the dislocation of the bars to occur when the boat hit the sea bed as it sank.

Hull leaks badly along the length of ship
9. During the inspection, the hull of the boat was found to leak badly all over. At the test site the coxswain stated that the boat was not leaking as badly on the day of the incident, and he further stated that he had the hull of the wooden boat caulked not too long ago before the incident. One could reasonably take that the boat was not leaking so badly on the day of incident, for otherwise the boat could not have travelled the far distance to reach the site of incident. Besides, the Police later found evidence that the hull of the boat had gone through a maintenance session just a few days before the incident. The hull leakage might be due to the boat was subject to brutal lifting forces during salvage, or that it was because it had been lying dry ashore in very dry weather (50% - 60% humidity) for many days, as that could cause the wood material of the hull to shrink.

III. Description of the cargoes and their loading on the boat

Cargo weight

10. I was shown by the Police the physical size of the cargoes that were carried onboard at the time of the incident. Details of the cargo carried onboard were:-

<table>
<thead>
<tr>
<th></th>
<th>Brick</th>
<th>Cement</th>
<th>Sand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statement from Truck driver</td>
<td>530 pieces</td>
<td>15 packs</td>
<td>5 packs</td>
</tr>
<tr>
<td>Weight per unit (approx.)</td>
<td>4 pound</td>
<td>45 kg</td>
<td>20 kg</td>
</tr>
</tbody>
</table>

Hence the total weight of the cargo placed onboard was 1736 kg. approx.

Dry and wet weight of cargoes

11. The weight of sand and cement mentioned above were dry weight. During foundering, when they got in touch with water, they would become much heavier as they could absorb water readily.

Position of the cargoes
12. According to the coxswain, the bricks were placed near the bow; and the sand and cement were placed at the aft end of the open deck forward of amidships, i.e. they were all at the forward part of the boat.

13. The bricks consisted of two crates which could be placed on top of each other. I have noted that the forward open deck had enough space to accommodate the above mentioned cargoes.

IV. People onboard

14. According to the statements, all people were sitting nearer to the aft end of the boat. They were not moving about in the boat apart from the last few minutes (about 10 minutes as I was told) before the boat sank, when one of the passengers moved forward to throw half of the number of the bricks into water.

V. Holds of the boat

15. Although the boat was divided into holds below its deck the only effective transverse bulkhead was the most forward one. All the other transverse bulkheads were not watertight at all, which means water that got into the boat could easily flood all the under deck holds, including the engine compartment.

16. If sea water got into the boat from the bow due to waves, it would get into the most forward hold. This hold could hold a substantial amount (weight) of water. This extra weight of water could bring the bow of the boat further down in water, such that sea water could get into the boat more easily.

VI. Buoyancy characteristic of a wooden vessel – BM40070C

BM40070C was mainly a piece of wood

17. BM40070C was a wooden hull vessel built with thick wood planking and was reinforced transversely by thick wooden transverse bulkheads. It had heavily built wooden bulwarks, thick wooden bow planking and thick wooden transom planking. The boat had a large wooden keel. All in all, it was a very heavily built wooden vessel. There were no metal frames, metal strengthenings or metal structural reinforcement for the boat. Therefore, the metal parts of the boat, in general, were mainly the engine, its tailshaft, propeller and the rudder.
What makes the boat sink

18. In theory, the boat in its light condition, even if it was totally immersed in water, the boat might not sink if the buoyancy of the wood material of the boat could support the overall weight of its engine, tailshaft and rudder. It is not known how much store there was already placed onboard. Nevertheless, if the boat was to sink, the buoyancy of the boat due to the buoyancy of its wood materials must be less than the total weight of its engine, tailshaft, propeller, rudder and its assembly, together with its stores (if any) plus the total weight of its cargoes.

Loaded waterline

19. As the boat was leaking badly it was not able to establish at the investigation site the loaded waterline and the trim of the boat just before the incident. The coxswain however showed to me at site the waterline of the boat when it was carrying cargoes. The waterline stated by him appeared to be reasonable (or believable) to me.

VII. Ship motion in wave

Ship motion and stability characteristics

20. BM40070C had a wide round hull body. Its wide aft body section had a much higher freeboard than the forward part of the boat body. Due to its wide fat aft body, a stern wave could push up the stern easily. Because of its transom stern, the boat could experience a large push forward when hit by a stern wave. When it happened, the bow would go downward. How much the bow would go down was depending on the shape of the hull body sections near the bow. The overall wide and round fat hull body of BM40070C could provide ample stability even with the fore-mentioned heavy cargoes on deck. The fact that people could move around onboard when seawater was getting into its holds and the boat did not capsize during the whole period of the incident before it sank indicated the boat was stable at the time of incident. That is to say, the weight and position of its cargoes (1737 kg), although heavy, should not have posed an instability problem for the boat in its intact normal condition. However, the weight distribution of the boat due to its heavy cargoes could make the boat vulnerable in its dynamic response to large waves. The bow of the boat might not rise so easily when the boat encountered a wave.
Shipping in water

21. In the above described situation, there was a high possibility for the boat to take in seawater from waves as the bow could not rise easily in response to wave actions. With the forward deck practically open, and that any shipped in water could not drain off quickly due to the lack of draining holes, seawater could accumulate quickly in the holds.

The sinking process

22. Once the most forward hold took in water, the bow would become even more difficult to rise in wave. Hence if waves continued to pound onto the bow more seawater could get in. When the waterline at bow was over the height of the bulwark at forward, large amount of seawater could get in and there would be no stopping of seawater getting below deck through the large openings on deck. The transverse bulkheads of the boat, although they were not watertight, could however momentarily slowed down seawater from getting to the aft end of the boat (the engine room area), causing the boat to trim forward quickly. Once it happened, much more seawater could enter the boat and the boat would sink quickly.

VIII. Observations

23. The following was observed:-

(a) The boat would remain stable before sinking.

(b) The boat was trimming heavily forward with its heavy cargoes placed at the front end.

(c) Due to the heavy cargo weight placed at the forward end it would be difficult for the bow to rise in wave. Also, the bow would be pushed downward if the boat encountered stern waves or rear quarter waves. Likewise, if the boat was hit by bow waves or quarterly bow waves the bow might not rise easily due to its cargoes.

(d) The boat sank as a result of foundering, not capsize. To achieve foundering large amount of seawater getting into the boat would be a necessary condition. Sea water might get into the boat in large quantity by either one of or a
combination of the following two reasons:-

(i) Sea water shipped on deck from bow; or

(ii) Sea water ingress from hull leakage at bottom.

(e) The Police had found evidence of the boat properly maintained just before the day of the incident. Therefore, the possibility of hull leakage could be small.

(f) If there were proper deck watertight arrangements on the open deck, that is, if the weather deck of the boat was properly designed and constructed, and that the boat operator had been careful in ensuring watertight integrity for the hull and its deck, the boat would not have sunk.

(g) If the boat had not carried the heavy cargoes and placed them in such a position to reduce the freeboard at bow significantly, the chance of seawater getting into the boat could be much reduced. However, note that even if the boat was not carrying the cargoes, in bad weather, the large hatch openings and the badly designed bulwark could still allow large amount of seawater to enter the boat and cause the boat to sink.

(h) The fact that, as reported by the salvage company, the boat was salvaged from sea bottom when it was free of cargoes (apart from a few pieces of bricks) may be taken as an indication that the buoyancy of wood material of the hull structures could not provide adequate buoyancy for the metal parts (engine, tailshaft, rudder and propellers and stores) of the boat.